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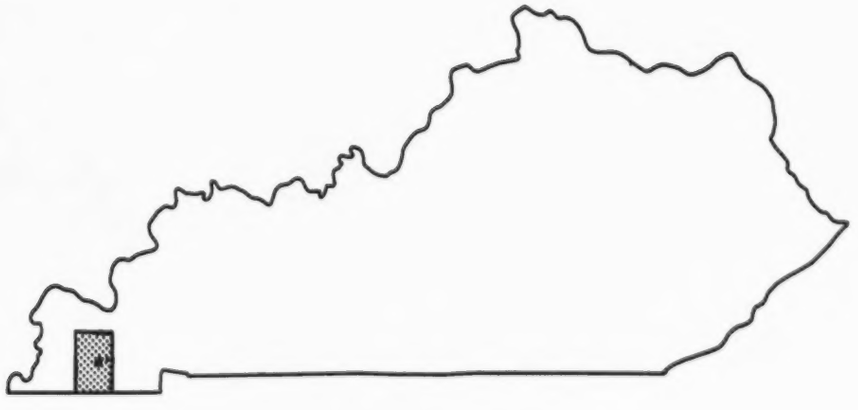
FLOOD INSURANCE STUDY

CITY OF MAYFIELD, KENTUCKY
GRAVES COUNTY



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federal emergency management agency
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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF MAYFIELD, KENTUCKY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Mayfield, Graves County, Kentucky, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Mayfield to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE) for the Federal Insurance Administration, under Interagency Agreement IAA-H-18-78, Project Order Number 3. This study was completed in August 1979.

1.3 Coordination

The identification of streams requiring detailed study was done in a meeting attended by personnel of the U.S. Army Corps of Engineers (COE), the FIA, and city officials in October 1976. Letters were sent to various state, federal, and private agencies informing them of the forthcoming Flood Insurance Study and requesting any pertinent information available.

On December 6, 1979, the results of the study were reviewed at the final meeting attended by representatives of the Corps of Engineers, the FIA, and community officials. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Mayfield, Graves County, Kentucky. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed and approximate studies in Mayfield were determined by representatives of the FIA, COE and community officials.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through 1984.

Flooding caused by overflow of Kess Creek from the downstream corporate limits of Mayfield to near the upstream corporate limits was selected for detailed study. Flooding of the city from Mayfield Creek, Oak Grove Creek, Red Duck Creek, Mayfield Creek Lateral A, Red Duck Creek Lateral, and the remainder of Kess Creek were studied by approximate methods.

2.2 Community Description

Mayfield is located in the middle of the Jackson Purchase sector of West Kentucky and is the county seat of Graves County. It is situated approximately 195 miles south of St. Louis, Missouri, and 127 miles north of Memphis, Tennessee. The 1970 population of Mayfield was 11,002 (Reference 1).

Mayfield began as a farming community and has become the world's largest exporter of dark leaf tobacco with some 10 million pounds sold annually. Industry today also plays a vital role in the community, employing approximately 5,000 people.

Mayfield Creek, which flows east of the city, is the principal stream of the area and is responsible for all of the drainage in the surrrounding area. Its drainage area within the study limits encompasses 107.3 square miles.

Oak Grove Creek, a tributary flowing east along the northern limits of the city to Mayfield Creek, has a drainage area of 2.7 square miles.

Mayfield Creek Lateral A flows east through the north central section of the city and has a drainage area of 1.29 square miles.

Red Duck Creek, a tributary flowing east through the center of the city to Mayfield Creek, has a drainage area of 3.6 square miles.

Red Duck Creek Lateral flowing east from Paris Road to Red Duck in the southeastern section of the city, has a drainage of 0.68 square miles.

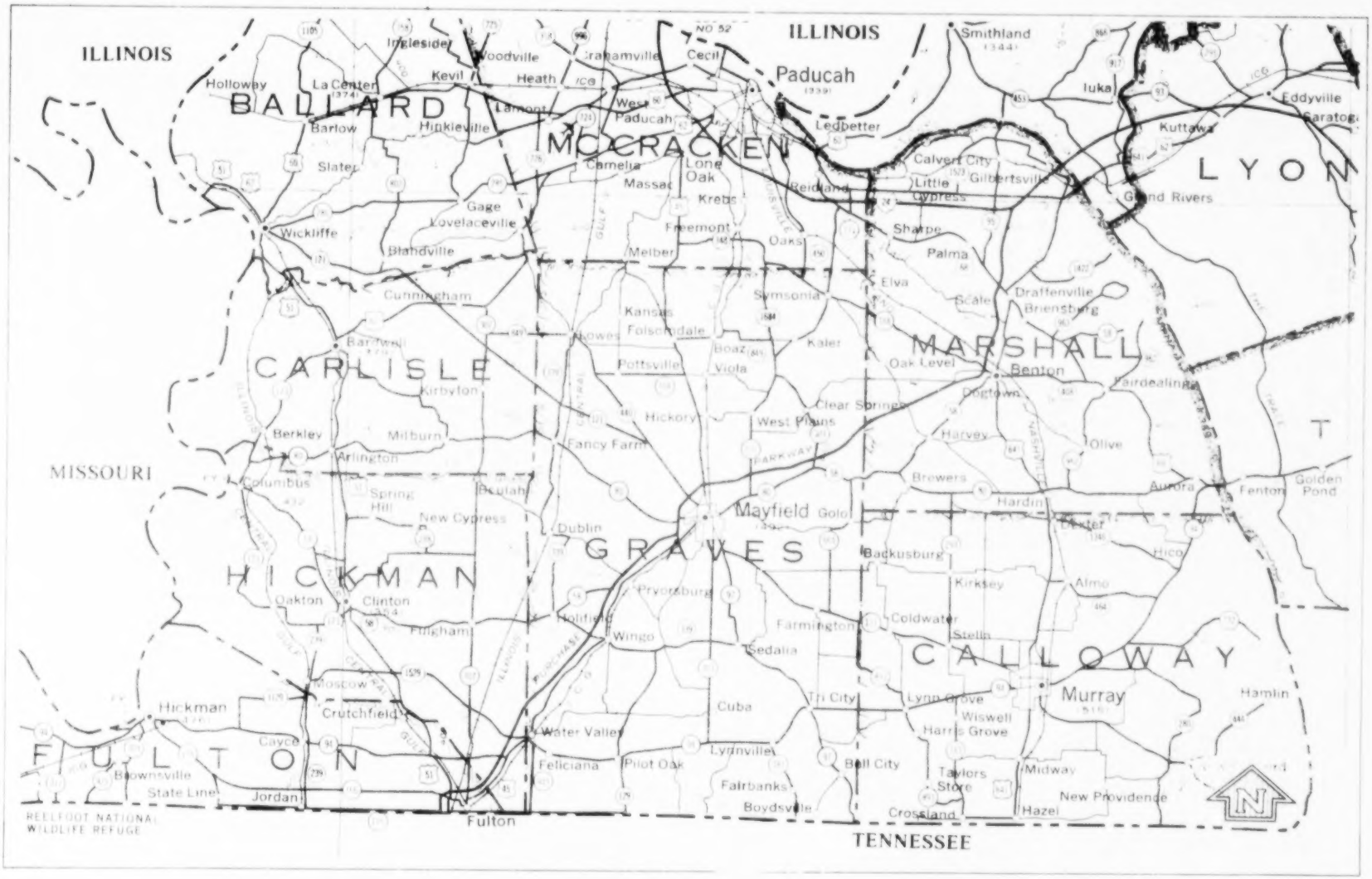


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

CITY OF MAYFIELD, KY

(GRAVES CO.)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

Kess Creek, immediately south of the city, flows east to Mayfield Creek and has a drainage area of 6.13 square miles.

The climate of Mayfield is characterized by fairly warm summers and cool winters. The annual average temperature is approximately 59 degrees F. Annual precipitation over the basin averages 45 inches with the major portion occurring in the winter and spring.

2.3 Principal Flood Problems

Floods have occurred in the City of Mayfield during all seasons of the year. The small streams within the city can rise from normal flow ot extreme flood peaks in a relatively short period of time, usually less than two hours. However, the time of rise for Mayfield Creek is much longer due to its larger drainage area.

Flooding in Mayfield is caused by heavy rainfall and the inability of the channels to carry the runoff from the basin, a condition resulting from several factors, such as the slope, cross section of the stream, sharp bends, bridge restrictions, and general stream encroachments.

Mayfield has experienced a number of floods in recent years. The three worst floods occuring in 1959, 1965, and 1966. The 1966 flood was a near record flood for the area when 10.61 inches of rain fell in 36 hour period. This rainfall is in excess of that required to produce a 500-year flood. The floods occurring in 1959 and 1965 are estimated to have been in the 100-year flood range.

Figures 2 and 3 show floodwaters in the study area.

2.4 Flood Protection Measures

There are no flood protection measures for the City of Mayfield. The COE completed a review report on Mayfield Creek and its tributaries in March 1972. The report concluded that no flood control or drainage improvements were economically feasible on any of the streams in the immediate Mayfield Area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent

FIGURE 2: Floodwaters of Big Creek Drainage Canal on south side of Millington/ Naval Air Station, 20 April 1973. (Official Photograph U.S. Navy)

FIGURE 3: Floodwaters of North Fork Creek along Navy Road, 19 April 1973. (See Paragraph 2.4)

chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Because there are no stream flow records for the streams in this study, peak discharges for floods of 10-, 50-, 100-, and 500-year recurrence intervals were obtained by applying various rainfall-duration amounts to units hydrographs developed along the streams. Rainfall frequency values were determined from the National Weather Service Technical Paper No. 40 for the 10-, 50-, and 100-year frequency rainfalls (Reference 2). Corresponding rainfall frequency for the 500-year frequency rainfall was determined by extrapolating the 10-, 50-, and 100-year frequency rainfall depths for given durations. Unit hydrographs were developed using Snyder's Method. Coefficients needed for Snyder's Method were developed by analyzing several gaged basins in the Memphis district.

The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
Stream Mile 2.97 (Cross section D)	1.42	1,319	1,671	1,849	2,269
Stream Mile 2.20	1.93	1,241	1,581	1,752	2,150

Due to the effects of valley storage, peak discharges decrease downstream in some instances.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

Water-surface profiles were developed using the HEC-2 computer program (Reference 3). This program uses the standard step-backwater method for natural channels and contains elaborate routines for evaluating head losses at bridges and culverts.

Cross section data and spot elevations within flood plains were obtained by field surveys performed during October and November 1977 and from aerial photographs flown in March 1972 (Reference 4).

These cross sections were extended across the flood plain using topographic map data (Reference 5), where necessary, for the hydraulic analysis. All bridges and culverts were surveyed to obtain elevation data and stuctural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

Roughness coefficients (Manning's "n") were estimated by field inspection and ranged from 0.07 for earth channels to 0.10 for overbank areas.

Starting water-surface elevations were obtained by the slope-area method and from previous studies of the COE.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

The water-surface elevations in the approximate areas were also determined using the HEC-2 computer program (Reference 3).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevation shown on the profiles are thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown and described on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using a topographic map at a scale of 1:6000, with a contour interval of 5 feet (Reference 4).

For those areas studied by approximate methods the boundaries of the 100-year flood were determined at cross sections; between cross sections the boundaries were interpolated using the same topographic map (Reference 4). In cases where the 100- and 500-year flood boundaries are close only the 100-year flood boundary has been shown.

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibits 3).

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

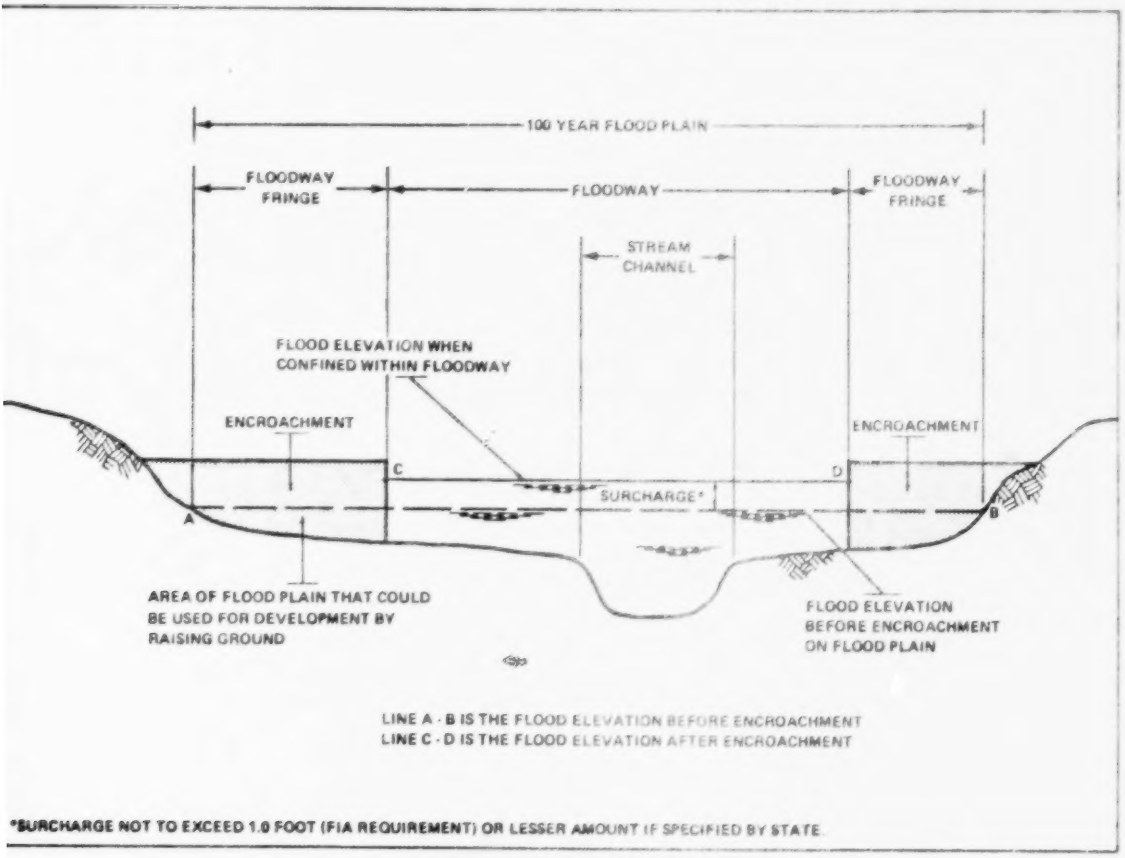
4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway for this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, boundaries were interpolated. In cases where the floodway and the 100-year boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 4.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 4

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Kess Creek								
A	2.03	110	588	3.47	471.7	471.7	472.7	1.0
B	2.44	127	660	2.73	476.7	476.7	477.7	1.0
C	2.51	125	627	2.87	477.6	477.6	478.4	0.8
D	2.97	80	545	3.30	483.1	483.1	484.1	1.0

[1]Miles above mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF MAYFIELD, KY
(GRAVES CO.)

FLOODWAY DATA

KESS CREEK

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source studied in detail affecting the City of Mayfield, Graves County, Kentucky.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot

The locations of the reaches determined for the flooding sources of the City of Mayfield are shown in the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Mayfield was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zone A1:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Mayfield is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

The U.S. Army Corps of Engineers published a Flood Plain Information Report on Mayfield and vicinity in December 1974 (Reference 6), and the U.S. Department of Housing and Urban Development issued a Flood Hazard Boundary Map on the city in January 1976 (Reference 7). The results of these studies are in agreement with the material presented in this report. This study is authoritative for the purpose of the Flood Insurance Program.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Kess Creek Reach 1	0002	-0.7	-0.2	+0.5	005	A1	Varies

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT – SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF MAYFIELD, KY
(GRAVES CO.)

FLOOD INSURANCE ZONE DATA

KESS CREEK

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, 1375 Peachtree Street, N.E., Atlanta, Georgia 30309.

8.0 BIBLIOGRAPHY AND REFERENCES

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2. U.S. Weather Bureau, Technical Paper 40, Rainfall Fequency Atlas of the United States, 1961.

3. U.S. Department of the Army, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, October 1973.

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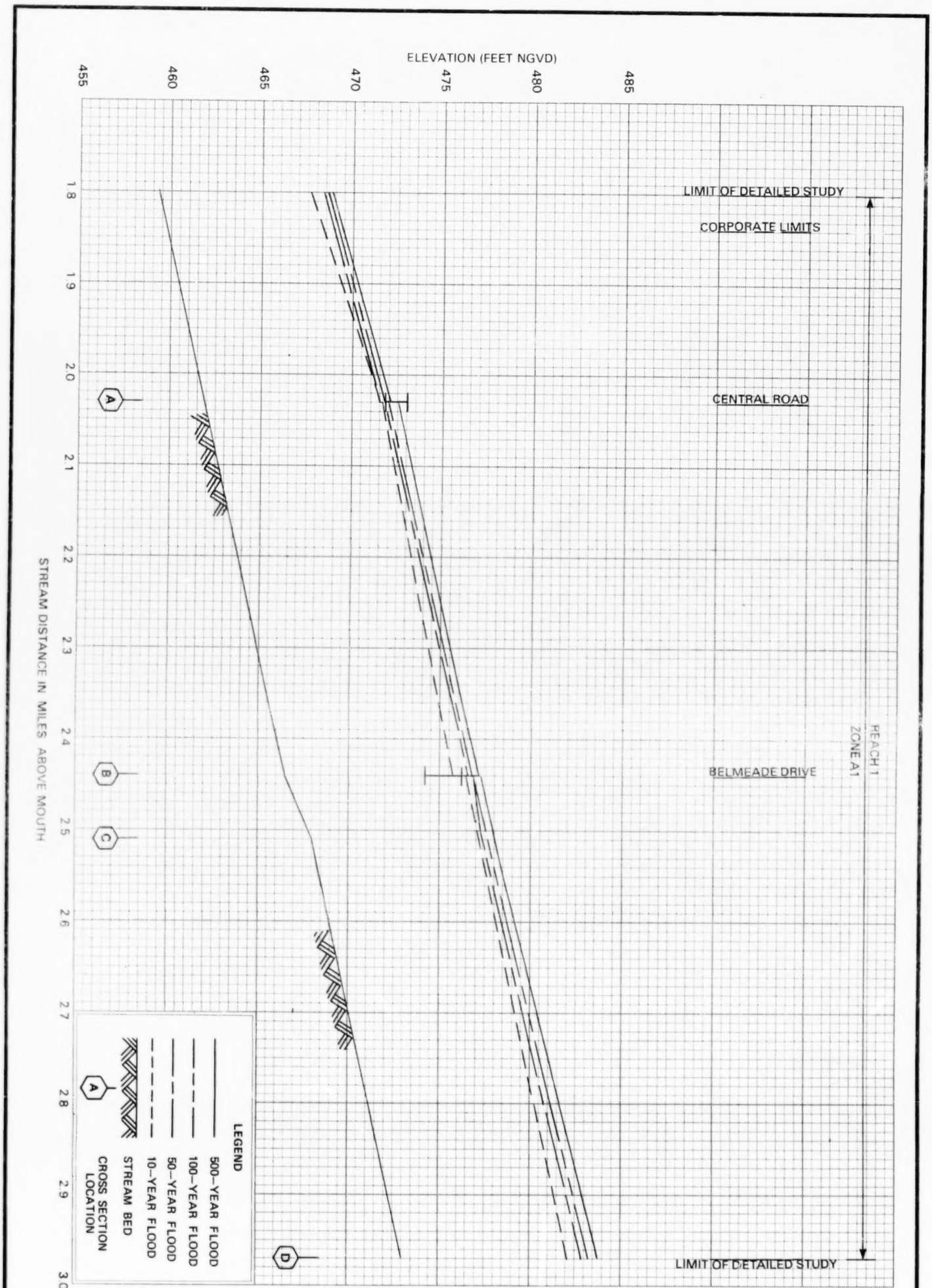
5. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 feet: Mayfield, Kentucky-Tennessee 1952; Hickory, Kentucky 1951.

6. U.S. Army, Corps of Engineers, Memphis District, Flood Plain Information Report, Mayfield, Kentucky, December 1974.

7. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Mayfield, Kentucky, January 1976.



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY Federal Insurance Administration **CITY OF MAYFIELD, KY** (GRAVES CO.)	**FLOOD PROFILES** **KESS CREEK**